

An Overview of Electricity in California



California Energy Commission

Fueled by a growing population and a robust economy, the demand for electricity in California is increasing.

In 2006, Californians spent nearly \$100 billion for energy, with electricity being roughly one-third of the total expenditures.

California produces about three-quarters of the electricity it uses; the rest is imported from the Pacific Northwest and neighboring states in the Southwest.

One of the state's most pressing challenges is to ensure adequate electricity supplies, so much so that California energy policy makers have established a "loading order" as the preferred approach to meeting new energy demand.

For electricity, the loading order lists energy efficiency and demand response first, renewable resources second, and infrastructure improvements, such as new or repowered clean, natural gas-fired power plants and new transmission lines, third.

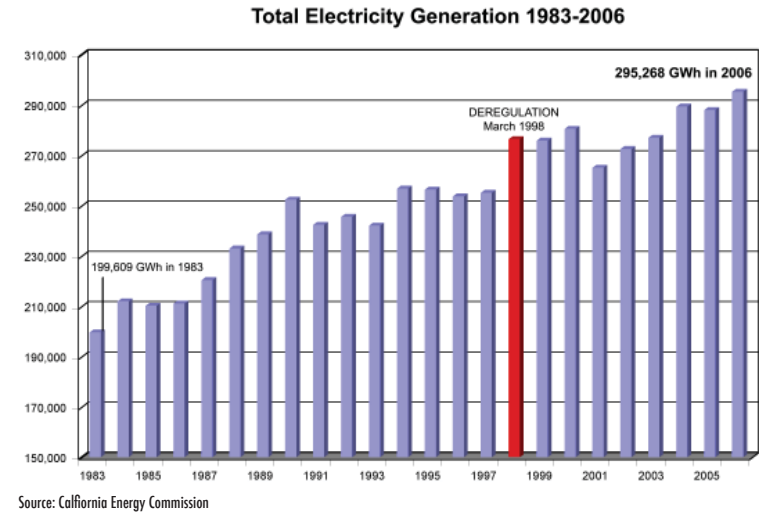
This document presents an overview of California's electricity system. At the end of this document, you will find a listing of California state agencies involved with energy, common acronyms and abbreviations, and definitions of some common terms.

For more information, please visit the California Energy Commission's website at:

www.energy.ca.gov

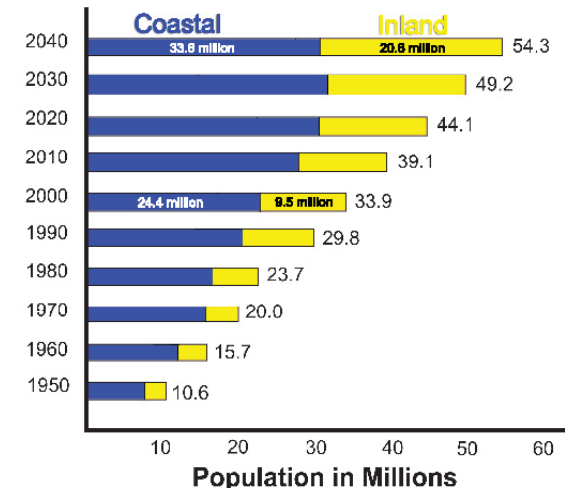
On the cover, clockwise: Wind turbines (David Wasserman, Brand X Photos), Sutter Power Plant Project (Calpine Corporation), close-up of photovoltaic/solar cell panel (David Wasserman, Brand X Photos), Geyser's geothermal power plant, (Calpine Corporation). Center: Transmission line towers (David Wasserman, Brand X Photos).

As We Grow, So Does Our Electricity Use

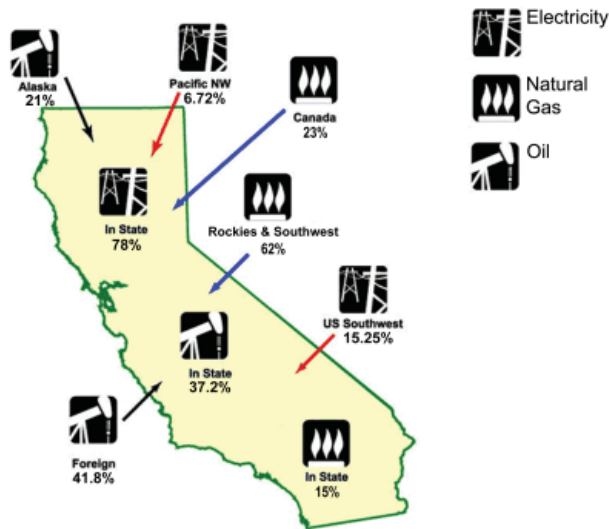


California's population increased from 23.7 million in 1983 to 36.5 million in 2006. At the same time, the amount of electricity produced increased from about 200,000 gigawatt-hours (GWh) in 1983 to nearly 300,000 GWh in 2006 (see above chart). Our Gross State Product increased from \$426 billion in 1983 to \$1.626 trillion in 2005 (latest data available).

Our population will continue to grow, but where it lives will be shifting from the coastal cities to inland, where there is heavier summertime electricity usage for air conditioners.



Where Our Energy Comes From



CALIFORNIA'S ENERGY SOURCES

California is a “net importer” of energy. In-state oil production is about 37% of the total, and natural gas produced in-state makes up 15% of the total. In-state electricity production accounts for almost 78% and is shown below broken down by source.

NATURAL GAS	LARGE HYDRO	COAL	NUCLEAR	GEO-THERMAL	BIOMASS	SMALL HYDRO	WIND	SOLAR
41.5%	19%	15.7%	12.9%	4.7%	2.1%	2.1%	1.8%	.2%
12% imported	23% imported	62% imported	16% imported	99% in-state	8% imported	7% imported	8% imported	100% in-state
88% in-state	77% in-state	38% in-state	84% in-state		92% in-state	93% in-state	92% in-state	
		The majority of these plants are located outside California but owned by California utilities.						

Source: California Energy Commission 2007 IEPR

Where Our Electricity Comes From

The majority of California's electricity comes from burning natural gas. That was followed in 2006 by hydroelectric, which fluctuates depending on the amount of rain, followed by nuclear, coal, and renewable resources (biomass, geothermal, small hydroelectric (less than 30 megawatts), solar, and wind). The total amount of electricity used is measured in gigawatts-hours and called the “gross system power.”

California Gross System Power for 2006

In Gigawatt-Hours (GWh)

Fuel Type	In-State	NW Imports	SW Imports	GSP	GSP Percentage
Coal ⁽¹⁾	17,573	5,467	23,195	46,235	15.7%
Large Hydro	43,088	10,608	2,343	56,039	19.0%
Natural Gas	106,968	2,051	13,207	122,226	41.5%
Nuclear	31,959	556	5,635	38,150	12.9%
Renewables	30,514	1,122	579	32,215	10.9%
Biomass	5,735	430	120	6,285	2.1%
Geothermal	13,448	0	260	13,708	4.7%
Small Hydro	5,788	448	0	6,236	2.1%
Solar ⁽²⁾	616			616	0.2%
Wind	4,927	244	199	5,370	1.8%
TOTAL	230,102	19,804	44,959	294,865⁽³⁾	100.0%

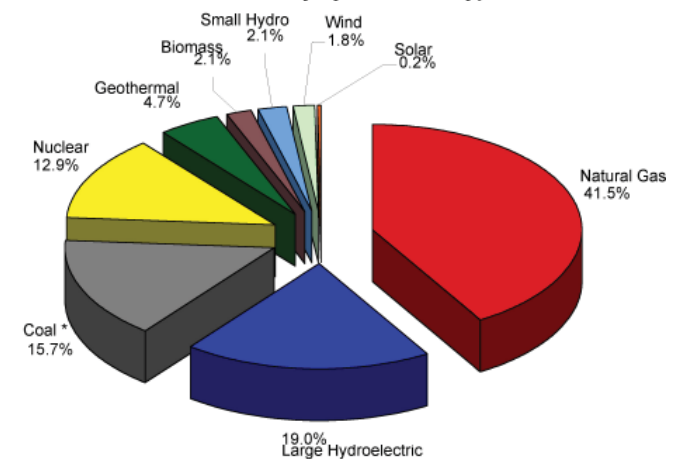
Source: 2006 Net System Power Report, Energy Commission Publication # CEC-300-2007-007.

(1) The in-state coal-fired generation includes electricity generated from several out-of-state coal-fired power plants that are owned by and reported by California utilities. There are other out-of-state generation facilities that are owned by California utilities, which are reported as imports.

(2) The number for solar only includes generator-reported electricity, not electricity produced by many small-scale photovoltaic installations throughout the state. Based on the the Energy Commission's Renewable Energy Program records, the state has financed approximately 135,517 kilowatts (kW) of solar photovoltaic capacity. Assuming that each installed kW of PV-generated 1,500 kWh in 2005, then the combined output of these PV systems would add another 203.3 gigawatt-hours to the gross system power totals.

(3) Gigawatt-hours for the Gross System Power are preliminary and calculated in early April and may differ from amounts shown on other charts that contain more complete or adjusted data.

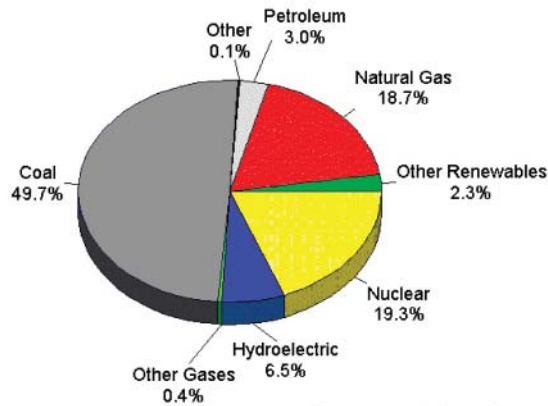
California's Electricity by Resource Type 2006



* Includes out-of-state coal plants owned by California utilities

Source: 2006 Net System Power Report, Energy Commission Publication # CEC-300-2007-007.

U.S. Electricity by Resource Type 2005



Source: U.S. DOE-EIA

By comparison, the entire United States relies more heavily on coal than does California. The breakdown of resources for the United States is: one-half of all electricity being supplied by coal, followed by nuclear 19.3 percent, then natural gas at 18.7 percent. Renewables only make up 2.3 percent of the U.S. total, with large hydroelectric facilities providing another 6.5 percent.

The California resource mix varies by utility, as seen in the chart below.

California Major Utilities' Resource Mix for 2006

Resource Type	Statewide	SCE	PG&E	SDG&E	LADWP	SMUD
Coal	15.7%	8.0%	3.0%	18.0%	48.0%	0.0%
Large Hydro	19.0%	5.0%	19.0%	10.0%	6.0%	47.0%
Natural Gas	41.5%	54.0%	42.0%	50.0%	30.0%	41.0%
Nuclear	12.9%	17.0%	23.0%	15.0%	10.0%	0.0%
Renewables	10.9%	16.0%	13.0%	8.0%	6.0%	12.0%
Biomass	2.1%	2.0%	5.0%	3.0%	1.0%	3.0%
Geothermal	4.7%	9.0%	2.0%	2.0%	<1%	3.0%
Small Hydro	2.1%	1.0%	4.0%	<1%	4.0%	3.0%
Solar	0.2%	1.0%	0.0%	<1%	<1%	1.0%
Wind	1.8%	3.0%	2.0%	3.0%	1.0%	2.0%

Source: 2006 Net System Power Report and Utility Power Content Label Data

California's Electric Utility Companies

California's utility companies are basically divided into investor-owned and publicly owned.

Major Investor-Owned Utilities

Pacific Gas and Electric Company (PG&E)

Southern California Edison (SCE)

San Diego Gas & Electric (SDG&E)

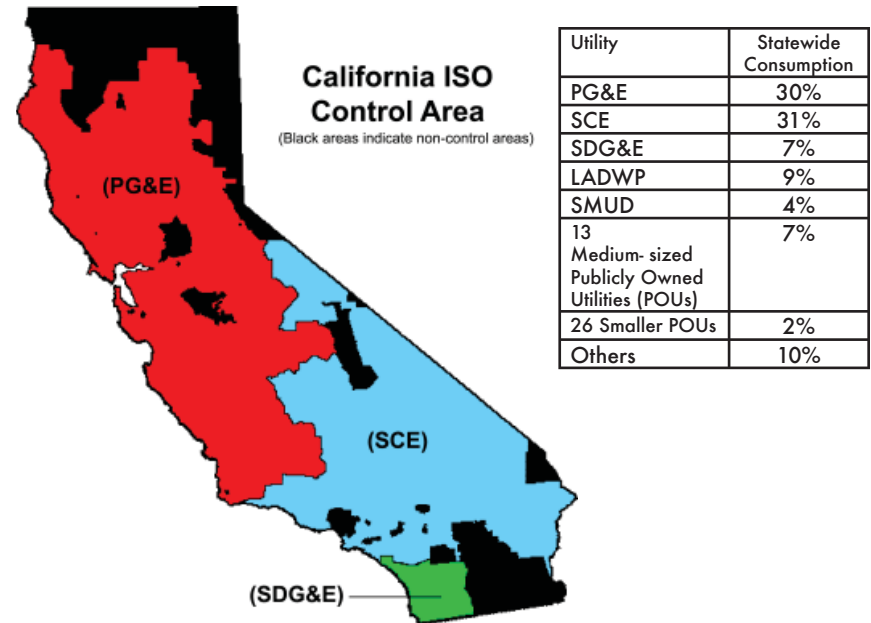
Major Publicly Owned Utilities

Los Angeles Department of Water and Power (LADWP)

Sacramento Municipal Utility District (SMUD)

The five major utilities listed above account for 81 percent of all the electricity consumed in the state. The remaining 19 percent is consumed by three smaller investor-owned utilities (Bear Valley Electric, Pacific Power, and Sierra-Pacific Power); 24 municipal utility districts; three rural electric cooperatives; roughly 12 irrigation, public utility, or water districts; and two state and federal water agencies (electricity is used for pumping water).

Under deregulation, the job of controlling the electricity in most of the state was given to the California Independent System Operator, which controls electricity for the investor-owned utilities and two small city utilities: PG&E, SCE, SDG&E, City of Pasadena, and City of Vernon.



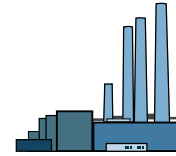
California's Electric Utilities in 2005

	Ownership	Number of Customers	Revenue (thousand dollars)	Sales (megawatt-hours)
Pacific Gas & Electric Co	Investor Owned	4,999,483	9,224,541	72,727,705
Southern California Edison Co	Investor Owned	4,674,231	9,445,101	75,301,581
City of Los Angeles	Public	1,438,226	2,257,469	23,400,472
San Diego Gas & Electric Co	Investor Owned	1,321,623	2,188,227	16,001,482
Sacramento Municipal Util Dist	Public	572,958	1,027,440	10,483,042
Imperial Irrigation District	Public	128,101	321,231	3,108,748
City of Anaheim	Public	110,773	236,948	2,553,464
Modesto Irrigation District	Public	107,056	224,527	2,582,599
City of Riverside	Public	102,454	211,226	1,989,207
Turlock Irrigation District	Public	93,917	154,062	1,808,573
City of Glendale	Public	83,367	136,345	1,104,909
City of Pasadena	Public	60,417	124,610	1,175,585
City of Burbank	Public	50,633	136,304	1,093,700
City of Santa Clara	Public	50,092	191,307	2,496,836
City of Roseville	Public	48,795	97,054	1,159,937
Sierra Pacific Power Co	Investor Owned	45,218	58,230	528,617
PacifiCorp	Investor Owned	43,906	65,075	836,674
City of Redding	Public	42,011	72,552	769,947
City of Alameda	Public	33,264	46,670	378,333
City of Lodi	Public	30,358	53,710	455,238
City of Palo Alto	Public	28,570	72,292	958,571
Southern California Water Co	Investor Owned	22,839	27,124	138,042
City of Colton	Public	18,126	39,156	342,569
City of Azusa	Public	15,529	27,433	251,266
City of Lompoc	Public	14,989	13,172	133,838
Truckee Donner Public Util District	Public	12,418	17,541	135,919
City of Banning	Public	12,108	17,850	144,447
Lassen Municipal Util District	Public	11,937	16,257	127,996
City of Ukiah	Public	8,847	14,681	111,894
Plumas-Sierra Rural Elec Co-op	Cooperative	7,117	13,761	153,368
Trinity Public Util District	Public	6,879	6,240	83,401
City of Healdsburg	Public	5,502	9,249	72,569
Merced Irrigation District	Public	4,585	34,659	345,224
City of Shasta Lake	Public	4,486	15,433	194,897
Surprise Valley Elec Corp.	Cooperative	4,204	5,142	76,147
Anza Electric Co-op Inc.	Cooperative	4,127	6,365	42,460
City of Needles	Public	2,917	6,199	62,277
City of Gridley	Public	2,489	3,891	32,033
City of Vernon	Public	2,052	96,500	1,137,854
City of Biggs	Public	671	1,537	19,144
City of Corona	Public	261	5,117	43,571
Western Area Power Admin	Federal	94	64,608	3,201,448
Valley Electric Assn, Inc.	Cooperative	43	571	6,796
Tuolumne County Pub Power Agny	Public	30	1,756	26,413
City & County of San Francisco	Public	11	57,269	782,758
City of Escondido	Public	1	1	18
Statewide Total		14,227,715	\$26,846,433	228,581,569

Source: U.S. Energy Information Administration, Table 10. Class of Ownership, Number of Bundled Ultimate Consumers, Revenue, Sales, and Average Retail Price for All Sectors by State, Utility, 2005. <http://www.eia.doe.gov/cneaf/electricity/esr/table10.xls>

How Much Does It Cost to Generate Electricity?

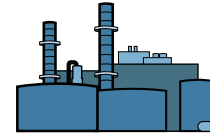
Levelized Cost of Electricity Generation by Resource (2003 Data)



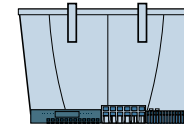
Coal
1.8 to 2.0¢/kWh



Geothermal
6.7 to 7.6¢/kWh



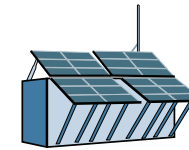
Natural Gas
5.2 to 15.9¢/kWh



Hydroelectric
0.25 to 2.7¢/kWh



Nuclear
1.4 to 1.9¢/kWh
Note: Does not include cost include construction and waste storage costs.



Solar
13.5 to 42.7¢/kWh



Wind
4.6¢/kWh

Costs of electricity per kilowatt-hour (kWh) vary within each category by resource type because there are various technologies within each fuel type. For example, electricity from natural gas can be produced by a combined cycle unit, a steam boiler, or a combustion turbine, as well as from cogeneration, each with different capital costs and efficiencies. Costs also vary by the location of the generation.

The costs shown above only include generation-related costs and not other costs that are included in the price paid by the customer. The costs listed do not include the cost of transmission, distribution, ancillary services, and other costs that are necessary to move the electricity from the point of generation to the point of use and maintain system reliability (a functioning electricity grid).

Source: Comparative Costs of California Central Station Electricity Generation Technologies (2007 Update), publication number CEC-200-2007-011-SD, and response to 8/7/06 Senator McClintock's Office Information Request on Electricity Costs by Type

How Much Does the Customer Pay for Electricity?

The highest utility rates are paid by customers of investor-owned utilities. Rates for investor-owned utilities are set by the California Public Utilities Commission. Publicly owned utilities have elected officials who set their own rates.

Utility-Wide Weighted Average Retail Electricity Prices 2006 (cents per kilowatt-hour)

PG&E	SCE	SDG&E	LADWP	SMUD	BGP
12.90	14.40	15.60	9.60	9.50	12.70

2006 California Average Retail Electricity Prices By Major Utility (cents per kilowatt-hour)

	PG&E	SCE	SDG&E	LADWP	SMUD	BGP
Residential	13.05	13.74	16.9	10.43	9.53	13.22
Commercial	14.00	16.77	15.26	10.09	9.86	12.70
Industrial	10.60	13.20	12.32	7.40	7.46	9.86
Agricultural	12.12	18.64	13.78	n/a	9.83	n/a

ABBREVIATIONS

PG&E = Pacific Gas and Electric Company
 SDG&E = San Diego Gas & Electric
 SMUD = Sacramento Municipal Utility District
 SCE = Southern California Edison Company
 LADWP = Los Angeles Department of Water and Power
 BGP = Municipal utilities of cities of Burbank, Glendale and Pasadena

Source: California Energy Commission staff

Western States' Average Retail Electricity Prices in 2005 (cents per kilowatt-hour)

	Residential	Commercial	Industrial	All Sectors
Arizona	8.86	7.4	5.85	7.79
California	12.51	11.92	9.55	11.63
Colorado	9.06	7.62	5.74	7.64
Idaho	6.29	5.42	3.91	5.12
Montana	8.1	7.43	4.83	6.72
Nevada	10.2	9.48	7.71	9.02
New Mexico	9.13	7.81	5.61	7.51
Oregon	7.25	6.51	4.83	6.34
Utah	7.52	6.07	4.24	5.92
Washington	6.54	6.33	4.27	5.87
Wyoming	7.48	6.17	3.99	5.16
U.S. Total	9.45	8.67	5.73	8.14

Source: U.S. Energy Information Administration

California has some of the highest electricity rates in the country, but we use the least amount of electricity per capita than the rest of the country.

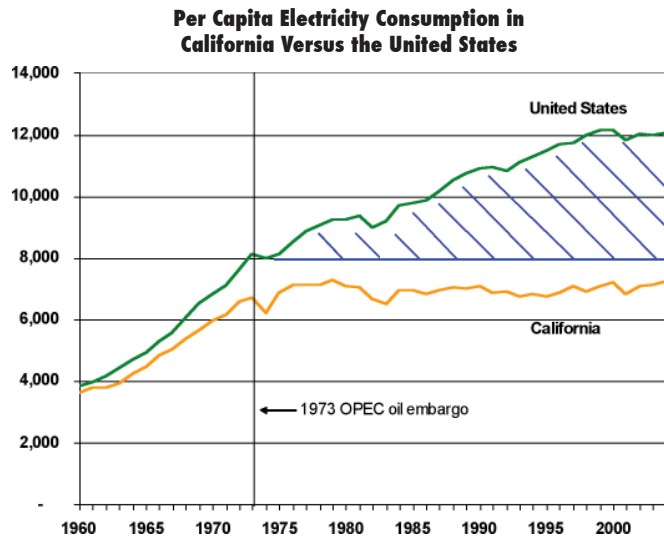
Per Capita Electricity Use by State 2004

Ranking /Highest	State	Population (thousands)	kWh (millions)	kWh per capita
1	Wyoming	509	14,138	27,787
2	Kentucky	4,173	89,351	21,414
3	District of Columbia	582	11,816	20,301
4	Alabama	4,548	89,202	19,612
5	South Carolina	4,247	81,254	19,132
6	Tennessee	5,956	103,905	17,446
7	Louisiana	4,507	77,389	17,170
8	North Dakota	635	10,840	17,081
9	Indiana	6,266	106,549	17,004
10	Arkansas	2,776	46,165	16,632
11	West Virginia	1,814	30,152	16,621
12	Mississippi	2,908	45,901	15,782
13	Nebraska	1,758	26,976	15,343
14	Idaho	1,429	21,853	15,288
15	Oklahoma	3,543	53,707	15,157
16	North Carolina	8,672	128,335	14,798
17	Texas	22,929	334,258	14,578
18	Georgia	9,133	132,265	14,483
19	Montana	935	13,479	14,420
20	Delaware	842	12,137	14,419
21	Iowa	2,966	42,757	14,418
22	Virginia	7,564	108,850	14,390
23	Kansas	2,748	39,024	14,200
24	Ohio	11,471	160,176	13,964
25	Missouri	5,798	80,940	13,961
26	Nevada	2,412	32,501	13,473
27	Washington	6,292	83,425	13,259
28	Minnesota	5,127	66,019	12,877
29	Oregon	3,639	46,419	12,756
30	Wisconsin	5,528	70,336	12,724
31	Florida	17,768	224,977	12,662
32	South Dakota	775	9,811	12,661
	UNITED STATES	296,507	3,660,969	12,347
33	Maryland	5,590	68,365	12,231
34	Pennsylvania	12,405	148,273	11,952
35	Arizona	5,953	69,391	11,656
36	Illinois	12,765	144,986	11,358
37	Michigan	10,101	110,445	10,934
38	New Mexico	1,926	20,639	10,716
39	Colorado	4,663	48,353	10,369
40	Utah	2,490	25,000	10,039
41	Connecticut	3,501	33,095	9,454
42	Vermont	622	5,883	9,452
43	New Jersey	8,703	81,897	9,410
44	Maine	1,318	12,363	9,378
45	Alaska	663	5,913	8,915
46	Massachusetts	6,433	57,228	8,895
47	New Hampshire	1,307	11,245	8,605
48	Hawaii	1,273	10,539	8,277
49	New York	19,316	150,148	7,773
50	Rhode Island	1,074	8,049	7,497
51	California	36,154	254,250	7,032

Sources: 2004 is latest data from U.S. Energy Information Administration
 Population - <http://www.census.gov/popest/states/tables/NSI-EST2006-01.xls>
 Kilowatt-hour - http://www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls

Though Electricity Is Expensive, We Use It Wisely

The information below is from a chapter in the soon-to-be-published book *Climate Change Science and Policy* edited by Schneider, Rosencranz, and Mastrandrea. One of the authors of the chapter is Energy Commissioner Arthur Rosenfeld.

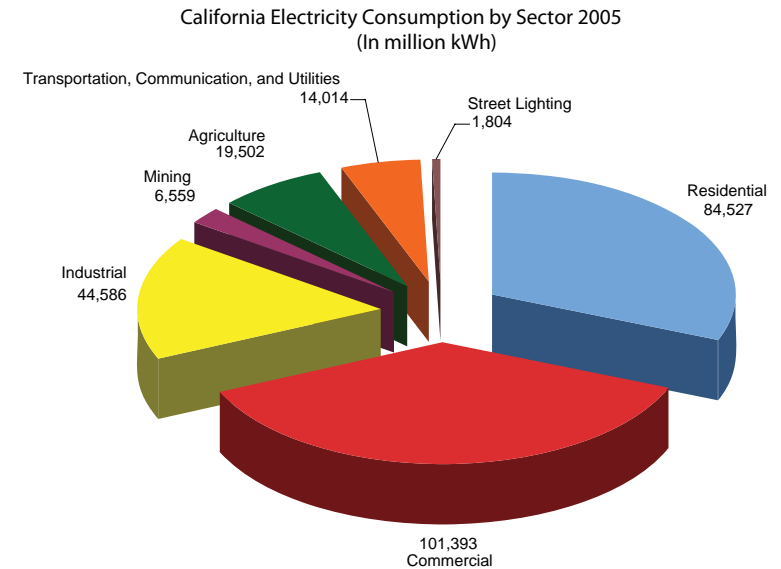


“California has pursued strong energy efficiency programs and policies, starting with the establishment of the state’s appliance (Title 20) and new-building (Title 24) standards in 1976 and 1978, respectively, and concurrent investments in energy efficiency programs across the state. The figure above shows that California’s historical energy efficiency policies have enabled the state to hold per-capita electricity use essentially constant, while in the U.S. as a whole, per-capita electricity use increased by nearly 50 percent since the mid-1970s.

“Differences in energy policy between California and the rest of the U.S. partially explain these divergent paths in per-capita electricity consumption. Although California’s relatively low per-capita consumption is partly due to a milder climate, the state’s gradual transition over time from a manufacturing-based economy to a service-based economy, and the demand-dampening effect of higher electricity prices, a significant portion of the difference in per-capita electricity use, as compared to the rest of the U.S., is due to policies and programs aimed at more efficient use of electricity. If California’s per-capita electricity use had grown at the same rate as the rest of the country since 1975, the state would have needed approximately 50 additional medium-sized (500 MW) power plants.”

From: “Energy Efficiency in California and the United States - Reducing Energy Costs and Greenhouse Gas Emissions,” by Audrey B. Chang, Natural Resources Defense Council; and Arthur H. Rosenfeld and Patrick K. McAuliffe, California Energy Commission. Publication number CEC-999-2007-007.PDF.

Where Is Our Electricity Used?



Source: California Energy Commission website

California’s commercial sector uses 37.2 percent of our electricity. It is followed by the residential sector with 31 percent, the industrial sector with 16.4 percent, and the agriculture sector with 7.2 percent. Transportation, communications and utilities use 5.1 percent, and streetlighting uses about 0.7 percent. In our homes, the largest use of electricity is for air conditioning during summer months.

California’s utilities served 12.4 million residential accounts in 2005 and 1.77 million non-residential accounts, which include commercial, industrial, and other types.

Broken down by county, we find the smallest, Alpine County, had 1,077 residential accounts, and the largest is Los Angeles County with more than three million residential accounts.

California Electricity Consumption by County in 2005

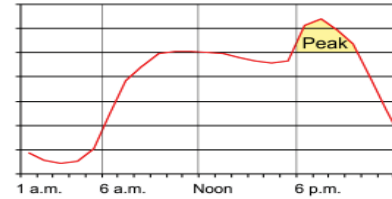
County	Residential		Nonresidential		Total	
	Number of Accounts	kWh (million)	Number of Accounts	kWh (million)	Number of Accounts	kWh (million)
ALAMEDA	541,813	3,008	61,228	8,053	603,041	11,061
ALPINE	1,077	8	171	9	1,248	17
AMADOR	16,612	133	2,947	159	19,559	293
BUTTE	89,762	682	16,174	673	105,936	1,355
CALAVERAS	25,385	187	3,368	112	28,753	299
COLUSA	7,636	63	3,074	173	10,710	236
CONTRA COSTA	382,264	2,646	36,326	5,529	418,590	8,175
DEL NORTE	10,089	124	1,790	124	11,879	247
EL DORADO	80,776	728	10,119	478	90,895	1,207
FRESNO	291,927	2,363	52,946	4,129	344,873	6,492
GLENN	10,609	89	3,803	274	14,412	363
HUMBOLDT	54,166	357	9,879	602	64,045	959
IMPERIAL	43,531	531	9,058	864	52,588	1,395
INYO	4,892	37	945	91	5,838	128
KERN	250,129	1,959	42,844	13,410	292,973	15,370
KINGS	38,829	326	9,180	960	48,009	1,286
LAKE	32,044	257	4,911	365	36,956	622
LASSEN	10,982	105	2,812	173	13,794	278
LOS ANGELES	3,071,899	19,796	358,286	49,380	3,430,185	69,177
MADERA	45,227	379	11,009	760	56,236	1,139
MARIN	104,830	683	14,860	738	119,690	1,421
MARIPOSA	9,183	67	1,586	38	10,769	105
MENDOCINO	35,980	289	7,821	277	43,801	566
MERCED	76,948	616	17,860	2,438	94,808	3,054
MODOC	5,361	58	1,980	105	7,341	163
MONO	11,976	102	1,933	88	13,909	189
MONTEREY	130,445	712	22,760	1,828	153,205	2,539
NAPA	50,761	368	8,956	576	59,717	944
NEVADA	37,306	395	5,084	254	42,391	648
ORANGE	1,021,106	6,652	228,293	13,519	1,249,398	20,171
PLACER	136,296	1,258	18,003	1,480	154,299	2,737
PLUMAS	12,388	102	2,449	93	14,836	195
RIVERSIDE	550,695	5,458	87,778	7,143	638,472	12,601
SACRAMENTO	513,439	4,546	69,324	6,029	582,762	10,574
SAN BENITO	17,462	115	3,406	187	20,868	302
SAN BERNARDINO	695,014	5,208	79,082	9,551	774,096	14,758
SAN DIEGO	1,098,946	6,330	137,042	11,922	1,235,988	18,252
SAN FRANCISCO	327,002	1,436	33,050	4,807	360,051	6,243
SAN JOAQUIN	213,012	1,631	36,257	3,566	249,269	5,197
SAN LUIS OBISPO	106,529	646	19,781	938	126,311	1,584
SAN MATEO	262,535	1,558	27,624	2,990	290,159	4,548
SANTA BARBARA	136,261	807	22,984	2,407	159,245	3,214
SANTA CLARA	568,138	3,863	70,836	11,679	638,974	15,542
SANTA CRUZ	91,233	558	12,417	817	103,650	1,375
SHASTA	73,326	711	11,527	860	84,853	1,571
SIERRA	1,927	15	356	10	2,283	25
SISKIYOU	21,748	237	4,950	323	26,698	560
SOLANO	144,749	994	16,390	2,050	161,139	3,044
SONOMA	186,571	1,230	28,394	1,598	214,965	2,828
STANISLAUS	175,424	1,654	30,990	3,183	206,415	4,837
SUTTER	32,035	258	7,770	310	39,805	568
TEHAMA	25,327	213	5,184	233	30,511	446
TRINITY	6,898	58	1,323	44	8,221	103
TULARE	128,865	1,073	37,225	2,257	166,090	3,331
TUOLUMNE	29,473	212	4,511	246	33,985	459
VENTURA	253,066	1,787	40,876	3,789	293,942	5,577
YOLO	69,613	489	10,313	1,135	79,926	1,624
YUBA	24,013	182	4,179	287	28,193	469
TOTAL	12,395,527	86,352	1,776,025	186,113	14,171,552	272,464

Source: California Energy Commission website

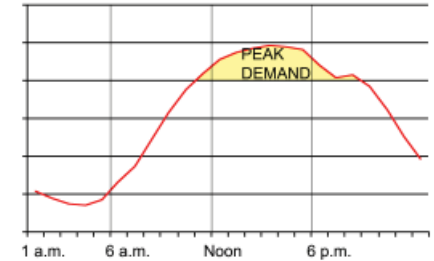
When Do We Use Electricity?

Electricity consumption follows time-of-day use patterns: low use over-night and higher use during the days. The highest point of electricity usage is called the peak demand. It is generally highest during afternoons on hot summer days where the temperatures can soar above 100 degrees F.

Typical Wintertime Demand



Typical Summertime Demand



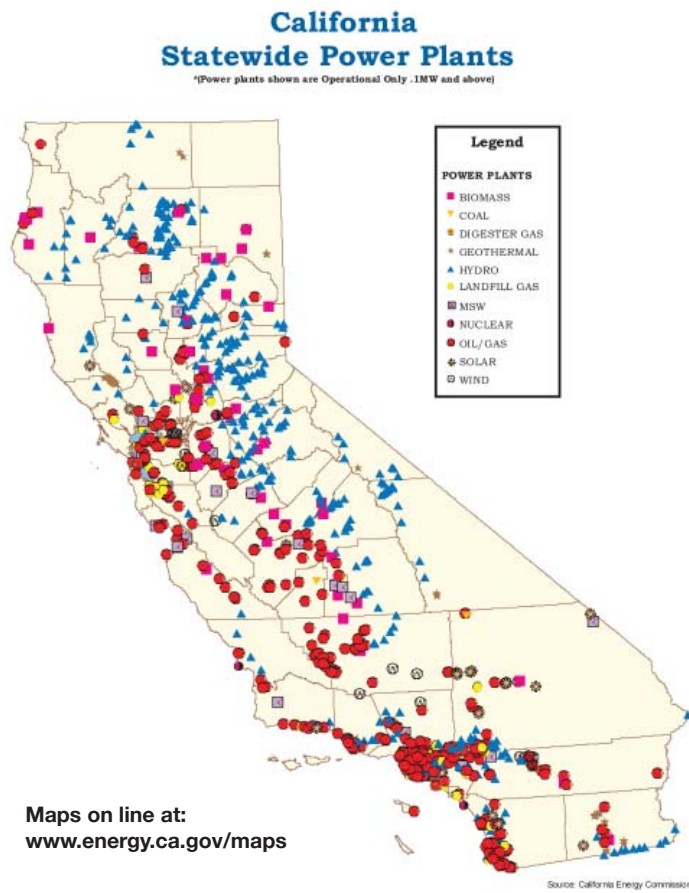
Graphs are for illustration purposes only.
They are not to scale and do not show equal ranges.

Year	Noncoincident Peak Demand - All Load in California (Megawatts)
1995	47,813
1996	50,189
1997	52,195
1998	54,658
1999	53,335
2000	53,129
2001	53,661
2002	49,814
2003	53,044
2004	56,282
2005	58,602
2006	63,809 record peak on July 24, 20006

Source: California Energy Commission website & staff

Power Plants In California

California has nearly 1,000 power generation facilities located within the state. These plants have an installed capacity of 67,336 megawatts (MW). A megawatt is equal to the amount of electricity used by 1,000 average California homes and 750 home during peak summertime demand. The largest power plant is the natural gas-fired Moss Landing power plant in Monterey County at 2,530 MW followed by San Onofre Nuclear Generating Station (2,254 MW), Diablo Canyon Nuclear Plant (2,218 MW), and Alamos Generating Station in Los Angeles (2,010 MW).



Those plants are connected to our homes, businesses, schools, and other buildings through nearly 40,000 miles of transmission lines. Those higher voltage lines connect to transformers and to hundreds of thousands of miles of local distribution lines. Below you'll see a map showing the major transmission lines in the state.



Power Plants Built Since Deregulation

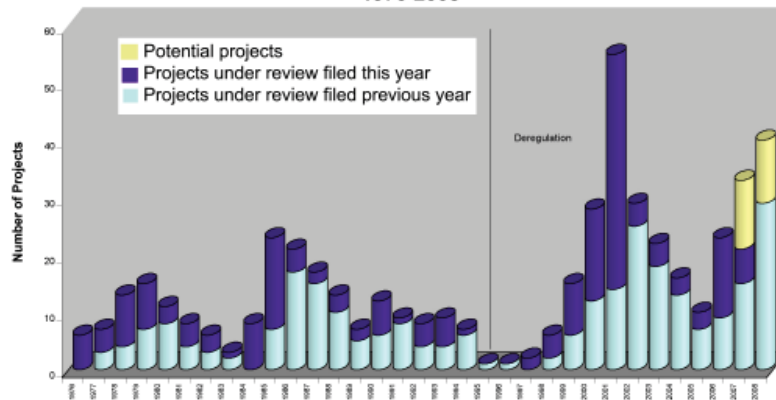
Since 1998 when deregulation occurred, the California Energy Commission has approved (or awarded Small Power Plant Exemptions to) 62 natural gas-fired power plants totaling 23,549 megawatts (MW). Thirty-six of these plants are on-line, producing 12,910 MW. As of September 2007, seven projects are under construction totaling 2,278 MW; with another 12 projects totalling 6,968 MW on hold for various reasons. Eighteen projects are in active review in the Energy Commission power plant licensing process, representing 7,512 MW. There are another two projects whose review is suspended totalling 247 MW. An additional 2,664 MW was added from 1999 to 2005 from projects that were smaller than 50 MW. (Thermal power plants smaller than 50 MW are not under the Energy Commission's licensing authority.)

Power Plants Online by Year Since Deregulation

Year	Number of Projects On Line	Total Capacity (Megawatts)
2006	5 facilities	1,487
2005	7 facilities	3,112
2004	0 facilities	0
2003	7.5 Facilities	3,668
2002	7 Facilities	2,729
2001	9.5 Facilities	1,914
1998 - 2000	0 Facilities	0
Total 1999-2006	36 Facilities	12,910

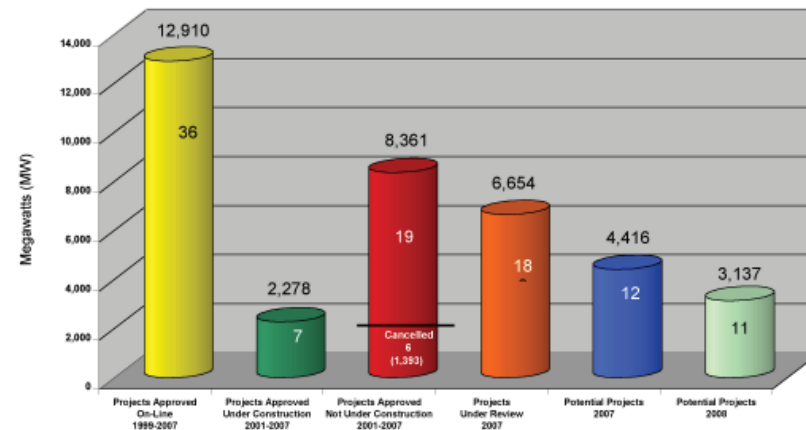
Source: California Energy Commission siting staff presentation

California Power Plants in Review 1976-2008



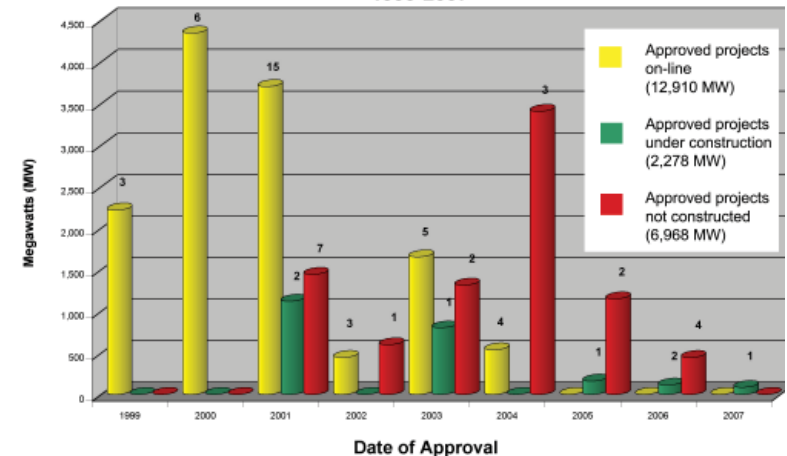
Source: California Energy Commission siting staff presentation

Power Plant Status Totals 1999-2008



Source: California Energy Commission siting staff presentation

Approved Power Plants 1999-2007



Source: California Energy Commission siting staff presentation

Renewable Energy

California with its abundant natural resources has had a long history of support for renewable energy. The oil crises of the 1970s gave rise to a concerns over dependency on fossil fuels. At that time, federal and state tax credits helped establish a new solar and wind industry and expanded geothermal development. Wind turbine farms cropped up in three primary locations - Altamont Pass, San Geronio Pass, and Tehachapi Pass.

Electricity deregulation legislation, namely Assembly Bill 1890 in 1996 and Senate Bill 90 in 1997, created the Renewable Energy Program administered by the California Energy Commission. That program had three main components described below. A companion program called the *Self-Generation Incentive Program* was begun by the California Public Utilities Program (CPUC) to provide incentives for larger solar photovoltaic projects bigger than 30 kilowatts.

These programs have helped increase total renewable electricity production statewide. This followed decades of bipartisan legislative and gubernatorial support for renewable energy, helping to make California a recognized leader in the field.

By 2006, 10.9 percent of all electricity came from renewable resources such as wind, solar, geothermal, biomass, and small hydroelectric facilities. Large hydroelectric plants generated another 19 percent of our electricity. By September 2007, nearly 26,000 solar electric systems were installed on homes and businesses helping to reduce electricity demand on the grid.

Existing Renewables Facilities Program

The Energy Commission's Existing Renewable Facilities Program provides funding in the form of production incentives to support existing renewable facilities while transitioning to a competitive market for their renewable energy products. As of June 30, 2006, the program has made payments to existing renewable facilities totaling over \$230 million for more than 66,087 GWh of generation. Payments for fiscal year 2005-2006 totaled \$20.8 million on 4,071 GWh of generation submitted.

New Renewables Program

The legislation directed that \$161 million should be spent to support prospective new renewable electricity generation projects built in California after September 26, 1996. The New Renewables Program funds are collected from ratepayers of the state's investor-owned utility companies.

These projects include biomass, digester gas, geothermal, landfill gas, small hydroelectric, and wind projects of various sizes, from 0.5 megawatts up to 75 megawatts. Through August 2007, a total of 82 projects have won auction bids under this program; 49 projects are on line, 12 are not yet on line, and 21 projects have been cancelled. The total of 491 megawatts have come on line and are producing power.

Emerging Renewables Program

The Emerging Renewables Program provided rebates and production incentives to end-use consumers who purchase and install renewable energy technologies, primarily solar photovoltaic and small wind systems, for on-site generation. Through July 2007, more than 26,000 PV systems, with an installed capacity of 217 MW, have begun producing clean electricity.

Renewables Portfolio Standard

California's Renewables Portfolio Standard (RPS) was established by Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002). It required the state's retail sellers of electricity—investor-owned utilities (IOUs), electric service providers (ESPs), and community choice aggregators (CCAs)—to procure 20 percent of their retail electricity sales with eligible sources of renewable energy by 2017. California's energy agencies subsequently volunteered to achieving the 20 percent target by 2010; seven years earlier than the target.

This 20 percent target was then mandated by the enactment of Senate Bill 107 (Simitian and Perata, Chapter 464, Statutes of 2006). The Energy Commission's 2004 Energy Policy Report Update calls for a goal of 33 percent by 2020.

Since the policy was established in 2002 and through March 2007, the state's investor-owned utilities - Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E) - have conducted a number of renewable energy solicitations. From these competitive solicitations, and also through bilateral negotiations, the investor-owned utilities have signed contracts for 2,935 to 4,433 megawatts (MW) of new and existing renewable energy projects (range reflects build-out options). This includes 2,121 to 3,618 MW for new, repowered, or restarted renewable facilities, with 324 MW of these projects currently online. In terms of percentages, 9 to 15 percent of the capacity under contract for new, repowered, or restarted renewable facilities have begun operations.

Biomass and Hydroelectricity

These two forms of electricity production have been around for scores of years. Biomass facilities burn agricultural waste, landfill gas, biogas (methane produced by break-down of animal wastes), urban waste, and other organic materials. These waste-to-energy power plants produced 2.1 percent of our electricity from 87 facilities in 2006.

Depending on the amount of rain, large hydroelectric facilities produces from 11.5 percent (in drought years) to 20 percent of our electricity from more than 300 hydro plants. In 2006, large hydro contributed 19 percent. Small hydro (power plants smaller than 30 megawatts) produced another 2.1 percent in 2006.

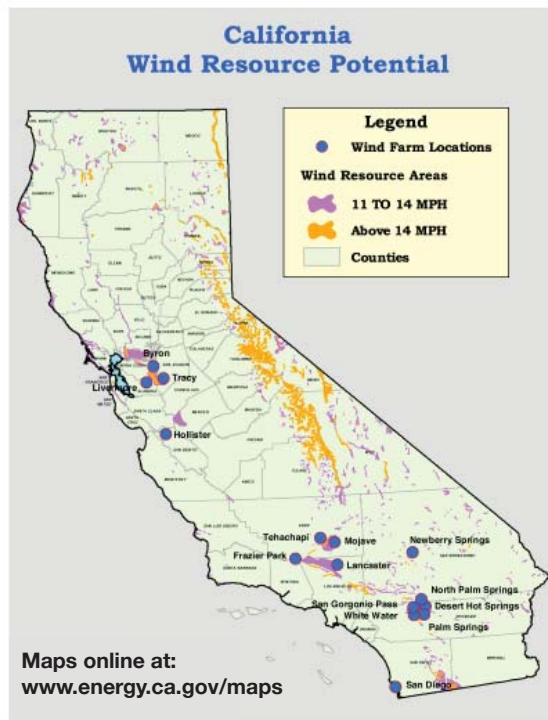
Wind Energy

Utility-scale wind farms are located in five perennially windy locations and produced about 1.8 percent of the state's total electricity. Those spots are the Altamont Pass near San Francisco, Pacheco Pass in southern Santa Clara County, Tehachapi near Bakersfield, and San Geronio near Palm Springs. While California used to be the world leader in wind-derived electricity, European countries have surpassed our state because of intensive governmental subsidies. In 2007, Texas passed California for largest total installed capacity in the United States, but additional new wind farms; replacement of older, less efficient turbines; and new transmission lines to connect new wind farms could return California to being the U.S. leader.

2003 Wind Energy Resources

Resource Site	Capacity (megawatts)	Generation (GWh)	Number of Turbines	Location
Altamont	562	1,071	4,788	Northern California
Solano	165	102	700	Northern California
Pacheco Pass	16	25	167	Central California
Tehachapi Ranges	710	1,482	3,444	Southern California
San Geronio Pass	359	893	2,556	Southern California
State Total	1,812	3,573	11,655	

Source: California Energy Commission website



Geothermal Energy

Geothermal energy is heat transferred from the planet's core to water and rocks that is closer to the surface, which can be used to make electricity. It is often associated with volcanic and seismically active regions. California, with its location on the Pacific "Ring of Fire," has 25 known geothermal resource areas, 14 of which have temperatures of 300 degrees Fahrenheit or greater. Forty-six of California's 58 counties have lower temperature resources for direct-use geothermal. In fact, the city of San Bernardino has developed the largest geothermal direct-use projects in North America, heating more than three dozen buildings – including a 15-story high-rise and government facilities – with fluids distributed through 15 miles of pipelines. Environmentally benign fluids are discharged to surface water channels after heat is used.

When added together, California's geothermal power plants produce about 40 percent of the world's geothermally generated electricity. The power plants have a dependable installed capacity of about 1,900 megawatts, producing 4.7 percent of California's total electricity in 2006.

The most developed of the high-temperature resource areas of the state is the Geysers. Located north of San Francisco, the Geysers was first tapped as a geothermal resource to generate electricity in 1960. It is one of only two locations in the world where a high-temperature, dry steam is found that can be directly used to turn turbines and generate electricity. The other location is Larderello, Italy.

Other major geothermal locations in the state include the Imperial Valley area east of San Diego and the Coso Hot Springs area near Bakersfield. It is estimated that the state has a potential of more than 4,000 megawatts of additional power from geothermal energy, using current technologies.



Solar Thermal Energy

Solar thermal power plants concentrates sunlight to heat a fluid that is used to make steam and then make electricity. Solar photovoltaics (direct conversion of sunlight into electricity) is discussed in the next section

Before deregulation in 1998, 13 solar thermal power projects were planned in California, with 11 of those filing applications with the California Energy Commission. Nine projects (Solar Energy Generating Station - SEGS I to IX), totaling 354 MW, were built. SEGS III to IX are owned by FPL Energy, and SEGS I and II are owned by Sunray Energy Inc.

Many large solar energy projects are being proposed in California’s desert area on federal Bureau of Land Management (BLM) land. BLM has received right-of-way requests encompassing more than 300,000 acres for the development of approximately 34 large solar thermal power plants totaling approximately 24,000 megawatts. This number of projects have not yet reached the stage of an Application for Certification (AFC) with the California Energy Commission.

Solar thermal projects (above 50 MW) on BLM land will require approvals from both the BLM and the Energy Commission prior to construction. To provide joint National Environmental Protection Act (NEPA) and California Environmental Quality Act (CEQA) review and a more efficient process, the

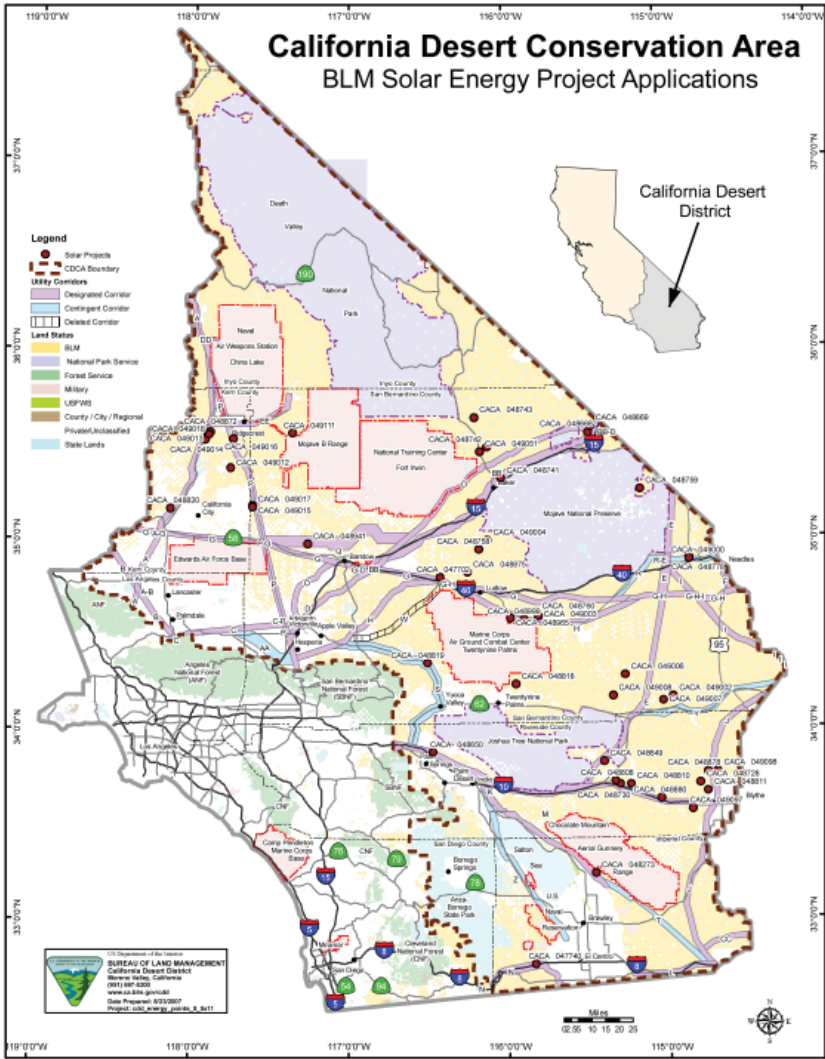
Large Solar Projects Under Review or Announced*
As of September 1, 2007

Project Name (Applicant)	Location	Size & Technology	Lead Agency	Status
Victorville 2 Hybrid Power Project (City of Victorville)	Victorville	563 MW 513 MW natural gas 50 MW solar trough	Energy Commission	Under Review application filed 2/28/2007
Ivanpah Solar (Brightsource)	San Bernardino County	400 MW solar tower	Energy Commission	Application for Certification filed 8/31/2007
Hybrid Gas & Solar (City of Palmdale)	Palmdale	570 MW 520 MW natural gas 50 MW solar trough	Energy Commission	AFC Not Yet Filed
Harper Lake Solar (Harper Lake LLC)	San Bernardino County	250 MW solar trough	Energy Commission	AFC Not Yet Filed
Stirling Solar Thermal One (Stirling Energy Systems)	San Bernardino County	850 MW Stirling Engine	Energy Commission	AFC Not Yet Filed
Stirling Solar Thermal Two (Stirling Energy Systems)	Imperial County	900 MW Stirling Engine	Energy Commission	AFC Not Yet Filed
TOTAL MW SOLAR		2,500		

* "Announced" refers to projects that were publicly announced in the news media or have made official declarations of intent.
Source: California Energy Commission website

BLM and Energy Commission have entered into a Memorandum of Understanding. This MOU and the map below are available to download from the Energy Commission’s website at: www.energy.ca.gov/siting/solar/.

The MOU also has attachments listing the solar projects the BLM is aware of (as of July 2007) and the timeline for the joint review process.



Source: U.S. Bureau of Land Management. Map available on Energy Commission website at www.energy.ca.gov/siting/solar

Solar Photovoltaic (PV) Energy

As part of Governor Arnold Schwarzenegger's Million Solar Roofs Program, California has committed \$3.5 billion and set a goal to install a total of 3,000 megawatts of installed capacity by 2017. The program moves the state toward a cleaner energy future and helping lower the cost of solar systems for consumers. The overall goal is to help build a self-sustaining photovoltaic, solar electricity market. The solar market has been growing over the last 50 years.

In 1954, D.M. Chapin, C.S. Fuller, and G.L. Pearson of Bell Laboratory patented a way of making electricity directly from sunlight using silicon-based solar cells. The next year, the Hoffman Electronics-Semiconductor Division announced the first commercial photovoltaic product that was 2-percent efficient, priced at \$25 per cell, at 14 milliwatts each, or \$1,785 per watt (in 1955 dollars). As of September 2007, the average price for solar cells, according to www.solarbuzz.com, was \$4.84 per watt.

We call modern-day devices that convert sunlight into energy photovoltaic cells, or "PVs" for short. More commonly, they're known as solar cells. We can find them on calculators, hats, sidewalk lighting systems, and alongside free-ways to power phones for stranded motorists.

As an outgrowth of space exploration and following the energy crises of the 1970s, PV development increased. In 1979, ARCO Solar began construction of the world's largest PV manufacturing facility in Camarillo, California. ARCO Solar was the first company to produce more than 1 megawatt of PV modules in one year. Four years later, ARCO Solar dedicated a 6 megawatt (MW) PV facility in Central California in the Carrissa Plain. The PV panels however, deteriorated in the hot sunlight, and the plant has subsequently been dismantled. Another large PV array was built by the Sacramento Municipal Utility District near its



Installing building-integrated PV panels on a new home in Rocklin, California, funded by the New Solar Homes Partnership.

Photo Credit: Adam Gottlieb, California Energy Commission

Rancho Seco Nuclear Plant. It went on line in August 1984 and has an installed capacity of 3.19 MW.

The growth of the solar industry was given a boost following deregulation in 1998. Ratepayers of the investor-owned utilities began funding a "public goods charge" that went to support renewable energy, energy efficiency rebates, and research and development. One of the rebates was for PV systems on homes and businesses connected to the utility grid. The Energy Commission's Emerging Renewables Program and the CPUC's Self-Generation Program offered rebates for solar electricity systems. These program ended December 31, 2006, when the Governor's \$3.3 billion Million Solar Roofs Program began.

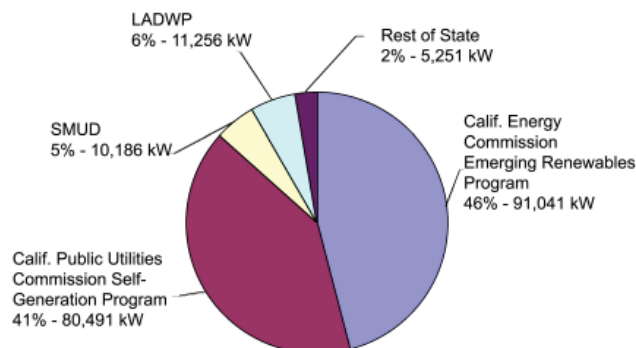
In January 2007, the California Public Utilities Commission, through its **California Solar Initiative**, began providing incentives for existing residential homes and existing and new commercial, industrial, and agricultural properties. The California Energy Commission has begun a new 10-year, \$400 million program to encourage solar in new home construction through its **New Solar Homes Partnership**.

From 1981 to deregulation in 1998, only a total of 6.2 MW of PV systems were connected to California's utility grid. Through July 2007, more than 26,000 PV systems, with an installed capacity of 217 MW, have begun producing clean electricity.

For more on rebates and incentives on solar, please visit the Go Solar California! website at:

www.gosolarcalifornia.org

Grid-Connected PV Capacity Installed in California
Cumulative kW Through 2006
(By Program Sponsor)



Source: California Energy Commission website

Electricity, Greenhouse Gases, and Climate Change



When I campaigned for governor three years ago, I said I wanted to make California No. 1 in the fight against global warming. This is something we owe our children and our grandchildren.

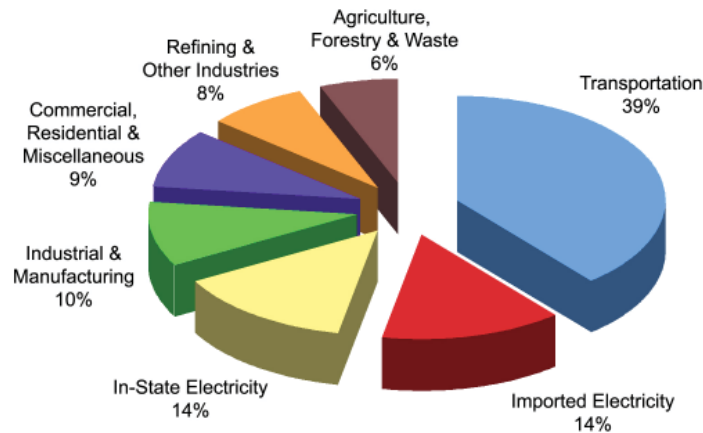
– Arnold Schwarzenegger

Last September, Gov. Schwarzenegger signed the Global Warming Solutions Action of 2006 (Assembly Bill 32 by Assembly Speaker Fabian Nuñez), California's landmark bill that established a first-in-the-world comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gases.

Greenhouse gases (mostly carbon dioxide) from electricity make up 28 percent of the total emitted by various sectors in the state. California's electricity generation is relatively efficient when it comes to emissions of greenhouse gases. The national average for the electricity generation share of total greenhouse gas emissions is approximately 40 percent, while California electricity accounts for only 14 percent of statewide emissions. This is in part due to California's significant amount of imported electricity, mild climate, and lack of energy-intensive industry.

Over the past two decades, California has developed one of the largest and most diverse renewable electricity generation industries in the world. However, changes

California's Gross Greenhouse Gas Emissions in 2004



Source: August 13, 2007, draft of ARB GHG Emissions Inventory

in climate of the magnitude predicted by the Intergovernmental Panel on Climate Change would substantially affect electricity generation throughout California and the entire Western States grid, particularly for hydroelectric facilities.

Less snowpack would result in lower levels of hydro generation in the summer and fall seasons due to reduced runoff in those seasons. Additional hydropower may be available during the winter and the spring. However, on balance hydropower is more useful and valuable within the grid mix of generation sources when it is available throughout the peak summer and fall seasons. The natural gas distribution system may also be damaged because of landslides and fires. Flooding could also impact pipelines, wells, and related petroleum extraction equipment. Warmer weather would result in an increased demand for electricity for air conditioning in homes and businesses.

On September 29, 2006, Governor Arnold Schwarzenegger signed into law Senate Bill 1368 (SB 1368 - Perata, Chapter 598, Statutes of 2006). The law limits long-term investments in baseload generation by the state's utilities to power plants that meet an "Emissions Performance Standard" (EPS) jointly established by the California Energy Commission and the California Public Utilities Commission (CPUC).

The Energy Commission has designed regulations that establish a standard for baseload generation owned by or under long-term contract to publicly owned utilities of 1,100 lbs CO₂ per megawatt-hour (MWh). This will encourage the development of power plants that meet California's growing energy needs while ensuring a minimal impact on the air quality and public health.

In 2007, the CPUC instituted a new greenhouse gas EPS to regulate contracts with electricity generation facilities. Mandated by SB 1368, the standard ensures that any long-term power commitments to meet California's energy needs are at least as clean as California's existing energy portfolio. This standard prevents new power contracts that increase emissions while a statewide program to limit emissions is designed and implemented.

The CPUC's 2004 "Greenhouse Gas Adder" policy requires investor-owned utilities to account for the financial risk associated with greenhouse gas emissions when evaluating new long-term resource investments. This additional cost consideration of \$8 per ton of carbon dioxide in long-term planning or procurement (five years or more) is now used by the utilities.

For more information on California response to climate change, information about the Governor's Climate Action Team, and other programs, please visit California's Climate Change Portal online at:

www.climatechange.ca.gov

Key Electricity-Related Legislation From 1996 to 2006

Year	Bill No. & (Author)	Chapter Number	Summary
1996	AB 1890 (Brulte)	854	"Provided the framework for the deregulation of the electricity market in California, created the Independent System Operator (ISO) and the Power Exchange, and established the public goods surcharge for investor-owned utilities. The surcharge funded public interest programs including the Public Interest Energy Research (PIER) program and renewable energy programs under the Energy Commission, and efficiency programs under the California Public Utilities Commission (CPUC)."
1997	SB 90 (Sher)	905	Provided the administrative and expenditure criteria necessary to implement the renewables support and public interest RD&D provisions for AB 1890.
2000	AB 970 (Ducheny)	329	"Established a 4-month power plant licensing process for simple cycle thermal facilities through 2004. Also established a 6-month process for any other thermal facilities that pose no significant environmental risk and had applications received by the Energy Commission before November 2000. Also appropriated \$50 million to the Energy Commission to implement an energy efficiency grant program, and required the Energy Commission to update the state's energy efficiency standards. Required the CPUC to enact demand reduction and peak-shaving measures and to identify and address constraints in the transmission and distribution grid."
	AB 995 (Wright) and AB 1194 (Sher)	1051	"Extended the public goods surcharge on electricity to fund public interest energy research, renewable energy support, and efficiency programs for 10 years."
	SB 1771 (Sher)	1018	"Established the "California Climate Action Registry" for the purpose of administering a voluntary greenhouse gas (GHG) emissions registry. Required the Energy Commission to qualify third-party organizations to provide assistance for purposes of monitoring and reducing GHG emissions. Also required the Energy Commission to develop metrics for use by the Registry and to update the State's inventory of GHG emissions."
2001	ABX 1	4	"Authorized the Department of Water Resources to enter into long-term contracts to buy electricity for resale to retail end-use customers, and with exceptions, to municipal utilities."
	SBX 28 (Sher)	12	Set a deadline to retrofit power plants with air pollution control technologies. Also re-established the 4-month siting process for simple cycle power plants. Established an expedited 6-month siting process for the repowering of existing thermal power plants through 2004.
2002	AB 1561 (Keeley)	421	"Required the Energy Commission to adopt a water factor standard for residential clothes washers by January 1, 2004, that would be at least as efficient as commercial washing machines. Also required the Energy Commission to petition the U.S. Department of Energy for a waiver from preemption of the federal standard."
	SB 1078 (Sher)	516	"Established the renewable portfolio standard, requiring retail sellers of electricity to increase procurement of electricity from renewable energy sources by at least 1 percent of retail sales per year until their portfolio of renewable energy increases to 20 percent. Set the deadline for reaching this threshold at 2017. Required municipal utilities to implement and enforce their own such program."

Year	Bill No. & (Author)	Chapter Number	Summary
2002	SB 1389 (Bowen)	568	"Established the biennial Integrated Energy Policy Report (IEPR). Realigned the Energy Commission's policy reporting, forecasting, and data collection responsibilities with restructured energy markets."
2004	SB 1776 (Bowen)	245	"Reinstated the Energy Commission's six-month licensing process for thermal power plants that pose no significant environmental risk through January 1, 2007."
2005	AB 380 (Núñez)	367	"Required the CPUC, in consultation with the ISO, to establish resource adequacy requirements for most load serving entities. The bill also required the Energy Commission to report, in each Integrated Energy Policy Report, publicly owned electric utility progress towards meeting resource adequacy."
	SB 1037 (Kehoe)	366	"Required the PUC, in consultation with the Energy Commission, to identify all potentially achievable cost-effective electricity efficiency measures. Required electrical and gas corporations to first meet their unmet resource needs through energy efficiency and demand reduction resources that are cost-effective, reliable, and feasible. Required publicly owned electric utilities to report their investments in energy efficiency programs annually to its customers and the Energy Commission. Codified energy efficiency as the first priority of the "loading order."
2006	AB 32 (Nuñez)	488	"Enacted the Global Warming Solutions Act of 2006, requiring the Air Resources Board to adopt regulations aimed at curbing GHG emissions."
	AB 1632 (Blakeslee)	722	Required the Energy Commission to assess the vulnerabilities of large existing generation facilities. Also required the Energy Commission to assess key issues affecting the future of nuclear energy and nuclear waste within the state.
	AB 2021 (Levine)	734	"Required publicly owned utilities to report on cost-effective efficiency measures and efficiency targets and to report investments in energy efficiency and demand mitigation programs. Also required the Energy Commission to summarize this information and report on achievable efficiency savings, and set targets for statewide efficiency savings statewide."
	SB 1 (Murray)	132	"Established the California Solar Initiative. Required the Energy Commission and the CPUC to implement a program aimed at installing 3,000 megawatts of solar energy systems on new and existing residential and commercial sites and placing solar energy systems on 50% of new homes by 2020."
	SB 107 (Smitian)	464	Accelerated the 20% target of the Renewable Portfolio Standard from 2017 to 2010. Also redirected funds toward the Existing Renewable Resources Account to achieve competitive and self-sustaining renewable facilities.
	SB 1059 (Escutia)	638	"Authorizes the Energy Commission to designate transmission corridors, and designates the Energy Commission as the lead agency for the California Environmental Quality Act for all proposed transmission corridor zones."
	SB 1250 (Perata)	512	"Reauthorized the Energy Commission's PIER Program and the Renewable Energy Program for five years, and established specific goals for the PIER program."
	SB 1368 (Perata)	598	Requires the Energy Commission to adopt a GHG emissions performance standard for long-term procurement of electricity by publicly owned utilities. This standard must be consistent with the standard adopted by the CPUC for load-serving entities under their jurisdiction.

Source: California Energy Commission Office of Governmental Affairs

Main California and Federal Energy Agencies



California Agencies

California Energy Commission (Energy Commission)

Websites: www.energy.ca.gov, www.gosolarcalifornia.org, www.consumerenergycenter.org
The California Energy Commission is the state's primary energy policy and planning agency. Created by the Legislature in 1974 and located in Sacramento, the Energy Commission has five major responsibilities:

- Forecasting future energy needs and keeping historical energy data.
- Licensing thermal power plants 50 megawatts or larger.
- Promoting energy efficiency through appliance and building standards.
- Developing energy technologies and supporting renewable energy.
- Planning for and directing state response to energy emergency.

With the signing of the Electric Industry Deregulation Law in 1998 (Assembly Bill 1890), the Energy Commission's role includes overseeing funding programs that support public interest energy research; advance energy science and technology through research, development and demonstration; and provide market support to existing, new, and emerging renewable technologies.

California Public Utilities Commission (CPUC)

Website: www.cpuc.ca.gov

The CPUC is a state constitutional agency that regulates privately owned telecommunications, electric, natural gas, water, railroad, rail transit, and passenger transportation companies, in addition to authorizing video franchises. Its five Governor-appointed Commissioners are "dedicated to ensuring that consumers have safe, reliable utility service at reasonable rates, protecting against fraud, and promoting the health of California's economy." Besides regulatory functions, the CPUC oversees the investor-owned utilities' energy efficiency and rebate programs through the Flex Your Power website (www.FYPower.org) and the California Solar Initiative through its program administrators (www.GoSolarCalifornia.org).

California Independent System Operator (California ISO)

Website: www.caiso.com

The California ISO is a not-for-profit public-benefit corporation charged with operating the majority of California's high-voltage wholesale power grid. Balancing the demand for electricity with an equal supply of megawatts, the ISO is the impartial link between power plants and the utilities that serve more than 30 million consumers. The ISO provides equal access to the grid for all qualified users and strategically plans for the transmission needs of this vital infrastructure.

California Electricity Oversight Board (EOB)

Website: www.eob.ca.gov

The California Electricity Oversight Board was created specifically to address issues arising in the restructured electricity industry and markets in California and reports directly to the Office of the Governor. The EOB works to ensure a reliable electricity system and just and reasonable wholesale electricity prices by providing oversight of the California Independent System Operator Corporation, monitoring and investigating matters in wholesale energy markets that may affect public interests of Californians, and representing the state in legal proceedings affecting these subjects.

Department of Conservation - Division of Oil, Gas and Geothermal

Website: www.consrv.ca.gov/dog/

The division oversees the drilling, operation, maintenance, and plugging and abandonment of oil, natural gas, and geothermal wells. The regulatory program emphasizes the wise development of oil, natural gas,

and geothermal resources in the state through sound engineering practices that protect the environment, prevent pollution, and ensure public safety.

Department of Community Services and Development (CSD)

Website: www.csd.ca.gov/

CSD is a department of the California Health and Human Services Agency. It administers the federally funded Low Income Home Energy Assistance Program (LIHEAP) Block Grant through three programs:

- The Weatherization Program provides free weatherization services to improve the energy efficiency of homes, including attic insulation, weatherstripping, minor housing repairs, and related energy conservation measures.
- The Home Energy Assistance Program provides financial assistance to eligible households to offset the costs of heating and/or cooling dwellings. For more information, call 1-866-675-6623.
- The Energy Crisis Intervention Program provides payments for weather-related or energy-related emergencies.

Department of General Services (DGS)

Website: www.dgs.ca.gov

DGS manages the state's real estate, purchasing, service agreements, publishing, telecommunications and transportation needs, school funding, administrative law hearings, insurance and risk policies, and building planning and design. At the same time, it employs practices that support the Governor's green initiative to reduce energy consumption and help preserve California resources.

California Energy Resources Scheduling Division

Website: <http://www.cers.water.ca.gov/>

The mission of this division of the Department of Water Resources is "To efficiently perform all statutory, legal, and fiduciary responsibilities regarding management of State long-term power contracts and servicing of power revenue bonds."



Federal Agencies

U.S. Department of Energy (DOE)

Website: www.energy.gov

The DOE's overarching mission is to advance the national, economic, and energy security of the United States; to promote scientific and technological innovation in support of that mission; and to ensure the environmental cleanup of the national nuclear weapons complex.

Federal Energy Regulatory Commission (FERC)

Website: www.ferc.gov

The Federal Energy Regulatory Commission is an independent agency that regulates the interstate transmission of electricity, natural gas, and oil. FERC also reviews proposals to build liquefied natural gas (LNG) terminals and interstate natural gas pipelines as well as licensing hydropower projects. The Energy Policy Act of 2005 gave FERC additional responsibilities.

Nuclear Regulatory Commission (NRC)

Website: www.nrc.gov

The NRC oversees nuclear reactor safety, reactor licensing and renewal, material safety and licensing, and waste management (storage and disposal).

Select Definitions

ALTERNATING CURRENT - (AC) Flow of electricity that constantly changes direction between positive and negative sides. Almost all power produced by electric utilities in the United States moves in current that shifts direction at a rate of 60 times per second.

APPLIANCE EFFICIENCY STANDARDS - California Code of Regulations, Title 20, Chapter 2, Subchapter 4: Energy Conservation, Article 4: Appliance Efficiency Standards. Appliance Efficiency Standards regulate the minimum performance requirements for appliances sold in California and apply to refrigerators, freezers, room air conditioners, central air conditioners, gas space heaters, water heaters, plumbing fittings, fluorescent lamp ballasts and luminaires, and ignition devices for gas cooking appliances and gas pool heaters. New National Appliance Standards are in place for some of these appliances and will become effective for others at a future date.

AVERAGE COST - The revenue requirement of a utility divided by the utility's sales. Average cost typically includes the costs of existing power plants, transmission, and distribution lines, and other facilities used by a utility to serve its customers. It also includes operating and maintenance, tax, and fuel expenses.

AVERAGE DEMAND - The energy demand in a given geographical area over a period of time. For example, the number of kilowatt-hours used in a 24-hour period, divided by 24, tells the average demand for that period.

AVERAGE HYDRO - Rain, snow, and runoff conditions that provide water for hydroelectric generation equal to the most commonly occurring levels. Average hydro usually is a mean indicating the levels experienced most often in a 104-year period.

AVOIDED COST - (Regulatory) The amount of money that an electric utility would need to spend for the next increment of electric generation to produce or purchase elsewhere the power that it instead buys from a cogenerator or small-power producer. Federal law established broad guidelines for determining how much a qualifying facility (QF) gets paid for power sold to the utility.

AVOIDED COST - The cost the utility would incur but for the existence of an independent generator or other energy service option. Avoided cost rates have been used as the power purchase price utilities offer independent suppliers (see Qualifying Facilities).

BASE LOAD UNIT - A power generating facility that is intended to run constantly at near capacity levels, as much of the time as possible.

BIOMASS - Energy resources derived from organic matter. These include wood, agricultural waste and other living-cell material that can be burned to produce heat energy. They also include algae, sewage and other organic substances that may be used to make energy through chemical processes.

BUILDING ENERGY EFFICIENCY STANDARDS - California Code of Regulations (California Code of Regulations), Title 24, Part 2, Chapter 2-53; regulating the energy efficiency of buildings constructed in California.

CAPACITY - The amount of electric power for which a generating unit, generating station, or other electrical apparatus is rated either by the user or manufacturer. The term is also used for the total volume of natural gas that can flow through a pipeline over a given amount of time, considering such factors as compression and pipeline size. There are various types of electricity capacity:

- **Dependable Capacity:** The system's ability to carry the electric power for the time interval and period specific, when related to the characteristics of the load to be supplied. Dependable capacity is determined by such factors as capability, operating power factor, weather, and portion of the load the station is to supply.
- **Installed (or Nameplate) Capacity:** The total manufacturer-rated capacities of equipment such as turbines, generators, condensers, transformers, and other system components.
- **Peaking Capacity:** The capacity of generating equipment intended for operation during the hours of highest daily, weekly or seasonal loads.
- **Purchased Capacity:** The amount of energy and capacity available for purchase from outside the system.
- **Reserve Capacity:** Extra generating capacity available to meet peak or abnormally high demands for power and to generate power during scheduled or unscheduled outages. Units available for service, but not maintained at operating temperature, are termed "cold." Those units ready and available for service, though not in actual operation, are termed "hot."

COGENERATION - Cogeneration means the sequential use of energy for the production of electrical and useful thermal energy.

COMBINED CYCLE PLANT - An electric generating station that uses waste heat from its gas turbines to produce steam for conventional steam turbines.

DEMAND (Utility) The level at which electricity or natural gas is delivered to users at a given point in time. Electric demand is expressed in kilowatts.

DEMAND SIDE MANAGEMENT (DSM) The methods used to manage energy demand including energy efficiency, load management, fuel substitution, and load building.

DISTRIBUTED GENERATION - A distributed generation system involves small amounts of generation located on a utility's distribution system for the purpose of meeting local (substation level) peak loads and/or displacing the need to build additional (or upgrade) local distribution lines.

DISTRIBUTION SYSTEM (Electric utility) - The substations, transformers, and lines that convey electricity from high-power transmission lines to ultimate consumers. See GRID.

ELECTRIC UTILITY - Any person or state agency with a monopoly franchise (including any municipality), which sells electric energy to end-use customers; this term includes the Tennessee Valley Authority, but does not include other federal power marketing agency (from National Energy Policy Act of 1992).

ENERGY EFFICIENCY - Using less energy/electricity to perform the same function. Programs designed to use electricity more efficiently - doing the same with less. "Energy conservation" is a term that has also been used but it has the connotation of doing without to save energy rather than using less energy to do the same thing. Many people use these terms interchangeably in error.

ELECTRICITY - A property of the basic particles of matter. A form of energy having magnetic, radiant, and chemical effects. Electric current is created by a flow of charged particles (electrons).

ENERGY - The capacity for doing work. Forms of energy include: thermal, mechanical, electrical, and chemical. Energy may be transformed from one form into another.

ENERGY RESOURCES PROGRAM ACCOUNT (ERPA) - The state law that directs California electric utility companies to gather a state energy surcharge per kilowatt hour of electricity consumed by a customer. These funds are used for operation of the California Energy Commission.

GEO THERMAL ENERGY - Natural heat from within the earth, captured for production of electric power, space heating, or industrial steam.

GIGAWATT (GW) - One thousand megawatts (1,000 MW) or, one million kilowatts (1,000,000 kW) or one billion watts (1,000,000,000 watts) of electricity. One gigawatt is enough to supply the electric demand of about one million average California homes.

GRID - The electric utility companies' transmission and distribution system that links power plants to customers through high power transmission line service (110 kilovolt [kv] to 765 kv); high voltage primary service for industrial applications and street rail and bus systems (23 kv-138 kv); medium voltage primary service for commercial and industrial applications (4 kv to 35 kv); and secondary service for commercial and residential customers (120 v to 480 v). Grid can also refer to the layout of a gas distribution system of a city or town in which pipes are laid in both directions in the streets and connected at intersections.

HYDROELECTRIC POWER - Electricity produced by falling water that turns a turbine generator. Also referred to as HYDRO.

IMPORTS (Electric utility) - Power capacity or energy obtained by one utility from others under purchase or exchange agreement.

INDEPENDENT POWER PRODUCER - An Independent Power Producer (IPP) generates power that is purchased by an electric utility at wholesale prices. The utility then resells this power to end-use customers. Although IPPs generate power, they are not franchised utilities, government agencies or QFs. IPPs usually do not own transmission lines to transmit the power that they generate.

INTERCONNECTION (Electric utility) - The linkage of transmission lines between two utilities, enabling power to be moved in either direction. Interconnections allow the utilities to help contain costs while enhancing system reliability.

INVESTOR-OWNED UTILITIES - A private company that provides a utility, such as water, natural gas, or electricity, to a specific service area. The investor-owned utility is regulated by the California Public Utilities Commission

ISO - INDEPENDENT SYSTEM OPERATOR. A neutral operator responsible for maintaining instantaneous balance of the grid system. The ISO performs its function by controlling the dispatch of flexible plants to ensure that loads match resources available to the system.

KILOVOLT (kv) - One-thousand volts (1,000). Distribution lines in residential areas usually are 12 kv (12,000 volts).

KILOWATT (kW) - One thousand (1,000) watts. A unit of measure of the amount of electricity needed to operate given equipment. On a hot summer afternoon a typical home, with central air conditioning and other equipment in use, might have a demand of 4 kW each hour.

LANDFILL GAS - Gas generated by the natural degrading and decomposition of municipal solid waste by anaerobic microorganisms in sanitary landfills. The gases produced, carbon dioxide and methane, can be collected by a series of low-level pressure wells and can be processed into a medium Btu gas that can be burned to generate steam or electricity.

LOAD - The amount of electric power supplied to meet one or more end user's needs.

LOAD MANAGEMENT - Steps taken to reduce power demand at peak load times or to shift some of it to off-peak times. This may be with reference to peak hours, peak days, or peak seasons. The main thing affecting electric peaks is air-conditioning usage, which is therefore a prime target for load management efforts. Load management may be pursued by persuading consumers to modify behavior or by using equipment that regulates some electric consumption.

MARGINAL COST - In the utility context, the cost to the utility of providing the next (marginal) kilowatt-hour of electricity, irrespective of sunk costs.

MARKET CLEARING PRICE - The price at which supply equals demand. The Day Ahead and Hour Ahead Markets.

MEGAWATT (MW) - One thousand kilowatts (1,000 kW) or one million (1,000,000) watts. One megawatt is enough energy to power 1,000 average California homes.

MUNICIPAL ELECTRIC UTILITY - A power utility system owned and operated by a local jurisdiction.

MUNICIPAL SOLID WASTE - Locally collected garbage, which can be processed and burned to produce energy.

NUCLEAR ENERGY - Power obtained by splitting heavy atoms (fission) or joining light atoms (fusion). A nuclear energy plant uses a controlled atomic chain reaction to produce heat. The heat is used to make steam run conventional turbine generators.

PEAK LOAD OR PEAK DEMAND - The highest electrical demand within a particular period of time. Daily electric peaks on weekdays occur in late afternoon and early evening. Annual peaks occur on hot summer days.

PHOTOVOLTAIC (PV) CELL - A semiconductor that converts light directly into electricity.

POWER PLANT (Note: Two separate words, not one word.) - A central station generating facility that produces energy.

QUALIFYING FACILITY - QFs are non-utility power producers that often generate electricity using renewable and alternative resources, such as hydro, wind, solar, geothermal or biomass (solid waste). QFs must meet certain operating, efficiency, and fuel-use standards set forth by the Federal Energy Regulatory Commission (FERC). If they meet these FERC standards, utilities must buy power from them. QFs usually have long-term contracts with utilities for the purchase of this power, which is among the utility's highest-priced resources.

RDF (REFUSE DERIVED FUEL) - The fuel component of municipal solid waste (MSW), which is the by-product of shredding MSW to a uniform size, screening out oversized materials and isolating ferrous material in magnetic separation. The resulting RDF can be burned as a fuel source.

RELIABILITY - Electric system reliability has two components - adequacy and security. Adequacy is the ability of the electric system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and unscheduled outages of system facilities. Security is the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system facilities.

RENEWABLE ENERGY - Resources that constantly renew themselves or that are regarded as practically inexhaustible. These include solar, wind, geothermal, hydroelectric, and biomass. Although particular geothermal formations can be depleted, the natural heat in the earth is a virtually inexhaustible reserve of potential energy. Renewable resources also include some experimental or less-developed sources such as tidal power, sea currents and ocean thermal gradients.

RESERVE - The extra generating capability that an electric utility needs, above and beyond the highest demand level it is required to supply to meet its users' needs.

RESTRUCTURING - The reconfiguration of the vertically-integrated electric utility. Restructuring usually refers to separation of the various utility functions into individually-operated and -owned entities.

SELF-GENERATION - A generation facility dedicated to serving a particular retail customer, usually located on the customer's premises. The facility may either be owned directly by the retail customer or owned by a third party with a contractual arrangement to provide electricity to meet some or all of the customer's load.

SOLAR COLLECTOR - A component of an active or passive solar system that absorbs solar radiation to heat a transfer medium, which, in turn, supplies heat energy to the space or water heating system.

SOLAR CELL - A photovoltaic cell that can convert light directly into electricity. A typical solar cell uses semiconductors made from silicon.

SOLAR COLLECTOR - A surface or device that absorbs solar heat and transfers it to a fluid. The heated fluid then is used to move the heat energy to where it will be useful, such as in water or space heating equipment.

SOLAR ENERGY - Heat and light radiated from the sun.

SOLAR THERMAL POWER PLANT - means a thermal power plant in which 75 percent or more of the total energy output is from solar energy and the use of backup fuels, such as oil, natural gas, and coal, does not, in the aggregate, exceed 25 percent of the total energy input of the facility during any calendar year.

STEAM ELECTRIC PLANT - A power station in which steam is used to turn the turbines that generate electricity. The heat used to make the steam may come from burning fossil fuel, using a controlled nuclear reaction, concentrating the sun's energy, tapping the earth's natural heat, or capturing industrial waste heat.

STRANDED BENEFITS - Public interest programs and goals that could be compromised or abandoned by a restructured electric industry. These potential "stranded benefits" might include: environmental protection, fuel diversity, energy efficiency, low-income ratepayer assistance, and other types of socially beneficial programs.

TRANSFORMER - A device, that through electromagnetic induction but without the use of moving parts, transforms alternating or intermittent electric energy in one circuit into energy of similar type in another circuit, commonly with altered values of voltage and current.

TRANSMISSION - Transporting bulk power over long distances.

ULTRAHIGH VOLTAGE TRANSMISSION - Transporting electricity over bulk-power lines at voltages greater than 800 kilovolts.

WATT - A unit of measure of electric power at a point in time, as capacity or demand. One watt of power maintained over time is equal to 1 joule per second. Some Christmas tree lights use 1 watt. The watt is named after Scottish inventor James Watt and is capitalized when shortened to w and used with other abbreviations, as in kWh.

Common Acronyms and Abbreviations

AB (as in AB 32) ..	Assembly Bill
AC.....	alternating current
ACEEE	American Council for an Energy-Efficient Economy
AFC.....	application for certification
AMI	advanced metering infrastructure
ARB	(California) Air Resources Board (Note: Prefers ARB instead of CARB)
BACT	best available control technology
BGP	Burbank, Glendale, and Pasadena (individual public utilities grouped together)
BIPV	building-integrated photovoltaic
BLM	Bureau of Land Management
BPA.....	Bonneville Power Administration
Btu	British thermal unit
CalEPA	California Environmental Protection Agency
CalOSHA	California Occupational Safety and Health Administration
CALTRANS.....	California Department of Transportation
CCAA.....	California Clean Air Act
CCR	California Code of Regulations
CCSE	California Center for Sustainable Energy
CEC	California Energy Commission (Note: Prefers Energy Commission instead of abbreviation.)
CEQA	California Environmental Quality Act (pronounced SEE-qwah)
CESA	California Endangered Species Act
CO	carbon monoxide
CO2	carbon dioxide
COL.....	California Oregon Intertie
CPUC.....	California Public Utilities Commission
CSI.....	California Solar Initiative
CSLB	Contractors State License Board
DC.....	direct current
DOE	United States Department of Energy
DWR	(California) Department of Water Resources
EIA	U.S. Energy Information Administration (statistical arm of U.S. DOE)
EER.....	energy efficiency ratio
EMF	electromagnetic field
EIR	environmental impact report
EIS	environmental impact statement
EOB	Electricity Oversight Board
EPA.....	U.S. Environmental Protection Agency
EPRI.....	Electric Power Research Institute
EPS.....	emissions performance standard
ERP	Emerging Renewables Program
ERPA.....	Energy Resources Program Account
ESCO.....	Energy service company
ESP.....	electricity/energy service provider
FERC.....	Federal Energy Regulatory Commission
GHG.....	greenhouse gases
GW.....	gigawatt (one billion watts)
H2S.....	hydrogen sulfide
HVAC	heating, ventilation, and air conditioning
IEA	International Energy Agency
IEPR	Integrated Energy Policy Report
IOU.....	investor-owned utility
IPCC	Intergovernmental Panel of Climate Change
ISO.....	California Independent System Operator (Note: Prefers California ISO, not ISO.)

KGRA.....	known geothermal resource area
kW	kilowatt
kWe.....	kilowatt, electric
kWh.....	kilowatt-hour
LADWP	Los Angeles Department of Water and Power
LNG	liquefied natural gas
LORS	laws, ordinances, regulations, and standards
MCF	thousand cubic feet
MW	megawatt (one million watts)
MWh	megawatt-hour
NCPA	Northern California Power Agency
NERC	North American Electric Reliability Council
NRC	Nuclear Regulatory Commission
NRDC.....	National Resources Defense Council
NSHP.....	New Solar Homes Partnership
O3.....	ozone
PBI	performance-based incentives
PG&E	Pacific Gas and Electric Company
PIER	Public Interest Energy Research Program
PM10	particulate matter 10 micrometers in diameter
POU	publicly owned utility
PPM	parts per million
PURPA	Federal Public Utilities Regulatory Policy Act of 1978
PV	photovoltaic
QF	qualifying facility
QUAD.....	one quadrillion Btu
R&D	research and development
RD&D.....	research, development and demonstration
RETI	Renewable Energy Transmission Initiative
ROC	reactive organic compound
ROG.....	reactive organic gas
RPS.....	renewable portfolio standard
SB (as in SB 1)	Senate Bill
SCE.....	Southern California Edison Company
SDG&E.....	San Diego Gas & Electric
SEER.....	seasonal energy efficiency ratio
SEGS	Solar Electric Generating Station
SGIP.....	Self Generation Incentive Program
SMUD	Sacramento Municipal Utility District
SO2.....	sulfur dioxide
SO4.....	sulfates
SoCalGas	Southern California Gas Company
SONGS	San Onofre Nuclear Generating Station
SOx.....	sulfur oxides
SPPE.....	small power plant exemption
T&D.....	Transmission & distribution
TOU	time of use (rates)
UL	Underwriters Laboratories, Inc.
USEPA	U.S. Environmental Protection Agency
USFS.....	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS.....	U.S. Geological Survey
WAPA.....	Western Area Power Authority
WECC	Western Electricity Coordinating Council
WIEB.....	Western Interstate Energy Board
WRTA.....	Western Region Transmission Association

For more information
on energy in California
please visit:

www.energy.ca.gov

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